

## 41. On some Cases of Blindness in Marine Fishes.

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[Received April 24, 1913: Read May 20, 1913.]

Of recent years considerable attention has been given by numerous ichthyopathologists and fish-culturists to the sporozoid and bacterial diseases affecting those species of fish which in a live state form an article of commerce.

The important work of Hofer †, and the Monograph now appearing from the pen of de Drouin de Bouville ‡, are perhaps two of the best known contributions of a general character upon the subject. There are, moreover, numerous more or less important works upon those organisms giving rise to disease: the Myxosporidia, for example, have received considerable notice from such investigators as Balbiani §, Thelohan ||, Doflein ¶, and Gurley \*\*, to quote but a few of the authors upon the subject.

Work which has been performed, even within the past decade, upon the bacterial aspect of fish diseases is of too extensive a character to be cited, however briefly, here. The same applies to Saprophytic and other fungoid growths attendant upon bacterial lesions.

The investigations of J. Hulme Patterson and certain others upon Salmon disease are well known and important contributions to economic science in this respect. But with the exception of certain papers by G. H. Drew and Patterson's findings, so far as they apply to Salmon installed in sea-water, most of the literature dealing with disease in marine fishes is confined almost entirely to the œcology of pathogenic organisms. For, whereas there is no inconsiderable amount of the literature directed solely to the pathology of freshwater fishes, there is at present a remarkable paucity dealing with those of marine habitat.

The present paper, therefore, is put forward largely with a view to associating the pathological aspect of certain forms of eye diseases observed in marine fishes with those already described, in more or less general terms, in the case of freshwater species.

\* Communicated by JOHN HOPKINSON, F.L.S., F.Z.S.

† 'Handbuch der Fischkrankheiten.'

‡ 'Les Maladies des Poissons d'eau douce d'Europe.'

§ 'Leçons sur les Sporozoaires,' Paris, 1884, etc.

|| 'Recherches sur les Myxosporidies,' Bull. Soc. France et Belgique, ser. 4, vol. v. Paris 1894, etc.

¶ 'Die Protozoen als Parasiten und Krankheit Serrigers,' Jena, 1901. "Studien zur Naturgeschichte der Protozoen," Zoologische Jahrb. xi. 1889, etc.

\*\* "Myxosporidia, etc." Rep. U.S. Commissioner for Fish and Fisheries, 1892. Washington, 1894.

The several subjects described hereinafter were received by the writer from the Superintendent of the Brighton Marine Aquarium, Mr. E. W. Cowley, to whom thanks are due. Acknowledgment of much assistance in the preparation of this paper is also accorded to Mr. John Hopkinson and to the late Mr. G. Harold Drew.

Hofer\* traces the progress of the more usual form of blindness in freshwater fishes in the following manner: (*a*) Corneal "cataract" due to injury or pathogenic bacteria attacking the integument; (*β*) gradual necrosis of the cornea-epithel and outer surface of the cornea; (*γ*) perforation of the cornea. Complications which may occur are "Keratoglobus" in the earlier stages, and Saprophytic growth attendant upon the bacterial lesions.

In the case of several freshwater fishes, the same author describes a not uncommon form of blindness due to parasites (*Diplostomum* larvæ), but of all the marine fishes which herein receive notice, none has been affected in this manner. Moreover, it may be recorded that no evidence of Saprophytic growth occurred on even the worst examples †.

#### 1. *Traumatic Corneal Opacitis in a Conger Eel* (*Conger vulgaris*).

The subject of this note was a Conger Eel which measured 3 feet 7 inches. It had lived in the Aquarium for nearly six years, retaining complete health until November 1912, when, according to the Superintendent of the Aquarium, Mr. E. W. Cowley, it went completely blind within the space of a week. It was destroyed immediately, when, from an observation of its behaviour, both eyes appeared to have become wholly useless.

An examination of the head of this specimen showed that the right cornea-epithel was perforated in two places and the left in five, each perforation being just large enough to admit a seeker .5 mm. in diameter. Extensive penetration of sea-water followed probably by bacterial lesions had occurred throughout the under surface of the cornea-epithel, those on the left side extending to the adjacent epidermis of the gill-covers, destroying the colour-cells, and rendering the part affected opaque white. The eye itself, when superficially examined, was so completely dimmed as to render observation of the characteristic yellow iris difficult, except in strong light.

The term "corneal opacitis" would be somewhat loosely applied in this instance, since upon removal of the integument the cornea proper was found to be completely free from injury, and but slightly affected with opacitis.

\* *Op. cit.* p. 291 etc.

† For a determination of this fact the writer's thanks are due to Miss Lorraine Smith, of the British Museum.

The condition termed by Hofer \* "Keratoglobus," *i. e.* outward bulging of the cornea away from the pupil, did not affect either eye, the lenses retaining their normal position.

Blindness, therefore, in this instance was due apparently to mortification and bacterial lesions of the integument of the head passing over the eye attendant upon perforation of the cornea-epithel.

Hofer † remarks: "In the case of a fish weakened by disease, or in a dying condition, the organs of sight are deeply sunk in their orbits, whereas in a healthy fish the eyes somewhat protrude." In the present example this condition was wholly apparent, the eyes presenting the flabby appearance to be seen in a fish some hours after death.

It is highly probable, therefore, that perforation of the integument above the cornea, resulting in blindness, was largely due, in the present instance, to the susceptibility of the fish, already weakened by graver organic disease, to injury; and that incipient corneal opacities may sometimes be taken as a diagnostic of other disorders.

## 2. *Corneal Opacities in a Greater Weever* (*Trachinus draco*).

The chief difference between the condition of the eyes in the present example and that of the Conger Eel already described, lay in the fact that apparently no lesion of the cornea-epithel appeared to have taken place. The subject under consideration had lived for some years in the tanks at Brighton, and had attained the considerable measurement of  $15\frac{3}{4}$  inches. In this case partial blindness only had come about at the time when the specimen was examined. The left eye was less affected than the right, this showing a more or less evenly distributed film of dimness, as if the specimen had been immersed for a short time in weak formalin. The right eye, however, not only showed distinct spots of necrosis unevenly distributed throughout the surface of the cornea, but there was also a pronounced "keratoglobus." With reference to this latter feature, it may here be remarked that a gathering of aqueous humour in front of the pupil, causing the cornea to bulge outward to a considerable extent, may occur, doubtless as the result of concussion, in fish the eyes of which are otherwise apparently unaffected. At the Brighton Aquarium occasionally numbers of a shoal of mackerel may be observed with both eyes protruding in this way, but their undoubted lack of effectual vision appears in no way to interfere with their capability for maintaining position in a moving shoal. But it is a noticeable fact that they appear much thinner than their fellows consequent upon a more limited

\* *Op. cit.* p. 293.

† *Op. cit.* p. 290. The translations adhere as nearly as possible to the original text.

absorption of food. Not unfrequently, moreover, such examples present a certain broken-backed appearance, which, so it is stated by the attendant in charge of the tanks, is due to the fish, when first installed, persistently hammering themselves against the glass!

### 3. *Corneal Opacities and Cataract in Pollack* (*Gadus pollachius*).

The Pollack forming the subject of the present note were four young specimens ranging from  $7\frac{1}{2}$  to  $8\frac{1}{2}$  inches in length. At the time when they came under the writer's observation (in Sept. 1912) they had lived in the Aquarium, in a tank apart from other fish, for a period of about nine months. When first installed their sight appeared to be normal; but it seems that these particular fish had been taken on a position close inshore off Shoreham, where there is an outflow of chemical waste.

Mr. E. W. Cowley informed the writer that fish which were known to have come from this locality were as a rule refused for stock purposes, in view of the fact that, after a short period in the Aquarium, they invariably showed signs of disease. Hofer\* states: "Trout, etc., have been frequently attacked by perforation of the cornea and cataract through existing in waters impregnated with iron from drains"; and goes on to say, "It is not yet established whether these consequences are to be ascribed to iron salts in general or to any particular one." A lack of similar observation, viz.: the effect of industrial wastes, sewerage, etc., upon those marine fishes often frequenting estuaries and tracts of water in which such impurities are known to occur, prohibits any comparison. Yet it is a noticeable fact that the examples about to be described exhibit a form of blindness most frequently met with in various freshwater fishes (*e. g.* Pike, Perch, Carp, etc.).

At the time when the present specimens came under the writer's observation, they were without doubt totally blind, both eyeballs of each example presenting the opaque white appearance similar to that seen in the case of fish which have been boiled. The cornea in every case was but slightly affected, no apparent lesion being discernible on any part of the integument covering it. The general transparency, moreover, was considerably greater than it was in the case of either of the two preceding examples. On dissection it was found that the cornea protruded in front of the lens to a considerable extent (cir.  $2\frac{1}{2}$  mm.). A transverse section, taken through the centres of both eyeballs from two of the specimens, showed that the extent of necrosis attacking the interlocking fibres was practically the same, viz., equivalent to two-thirds of the entire diameter of the section. Vertical sections, *i. e.* from anterior to posterior aspect of the lens, showed

\* *Op. cit.* p. 291.

a slight increase on the anterior margin, the total extent, however, being slightly less than that observed in the transverse sections, amounting roughly to slightly less than half the diameter in affected tissue. The term "cortical cataract," as applied to the human subject, would perhaps aptly describe the condition observed when in its earlier stages\*.

The behaviour of these fish in the Aquarium is a matter deserving of some comment. Habitually they were observed to swim in mid-water, maintaining one position often for several minutes together, and seldom exhibiting much activity in movement. It is a somewhat remarkable fact, but one which the present writer, by an observation extending over several weeks, can personally vouch for, that on no occasion were any of the specimens seen to come in contact with each other, the sides of the tank, or the glass. Pollack with normal vision installed in an adjacent tank were easily attracted when a moistened finger-tip was rubbed rapidly up and down the glass causing vibration thereby, less freely by gentle tapping. The blind fish, even when situated within a few inches from the glass, made no effort to respond to this attraction.

When food, in the form of finely-cut fish, molluscs, etc., was offered, it was allowed to sink to the bottom and remain there for several minutes before a search after it was made. This took the form of a wholly haphazard grubbing about on the bottom, the fish often making a vigorous "bite" immediately beside a fragment, this operation being repeated until the morsel was secured. Although a sufficiency of food was placed in the tank daily, and on one occasion one individual fish was observed within the space of 15 minutes to secure three fragments of moderate size, all the specimens when examined post-mortem were found to be very ill-nourished and considerably below normal weight.

NOTE:—The writer is indebted to Mr. J. O. G. Ledingham, of the Lister Institute of Preventive Medicine, for the following report respecting the histological condition of the lens in one of the above specimens. This gentleman writes "I cut Celloidin sections of the fish's eye you sent to me in formalin. They were very difficult to cut owing to the fact that the lens proved to be completely calcareous. This was the only obvious lesion I could detect. I saw no micro-organisms in the sections; but, as you will understand, the sections were not satisfactory for the demonstration of micro-organisms."

\* *Vide* L. B. Harman, "Aids to Ophthalmology," p. 83.